Transition Elements Map

OCR A Level Chemistry A · 5.3.1 Transition elements and complexes

1 Transition elements

5.3.1(a), (b)

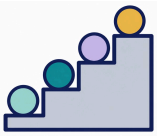
- Sc–Zn: write the configurations
- Ti–Cu: **transition elements**
- An ion with an **incomplete d-sub-shell**
- 4s fills first and is lost first



2 Properties

5.3.1(c)

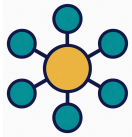
- More than one oxidation state
- Coloured ions
- **Catalysts** in industry
- Fe in the Haber process; V_2O_5

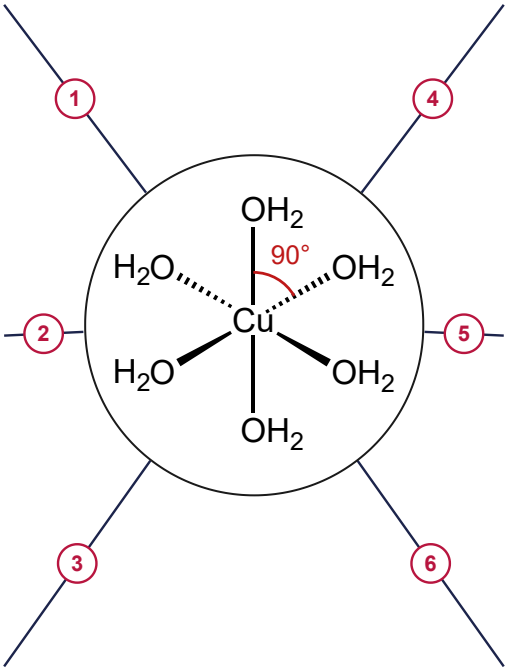


3 Ligands

5.3.1(d), (e)

- Coordinate (dative covalent) bond
- Complex ion; coordination number
- Bidentate: $NH_2CH_2CH_2NH_2$
- Charge = metal + ligands





4 Shapes

5.3.1(e)

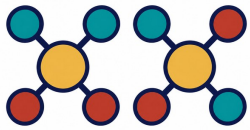
- Six-fold: **octahedral**, 90°
- Four-fold: **tetrahedral**, 109.5°
- Four-fold: **planar**, 90°
- Large Cl^-: only four fit



5 Stereoisomerism

5.3.1(f)

- **Cis-trans**: $Pt(NH_3)_2Cl_2$
- **Optical**: $[Ni(en)_3]^{2+}$
- Non-superimposable mirror images
- Some complexes show both



6 Cis-platin, haemoglobin

5.3.1(g), (i)

- Cis-platin **binds to DNA**
- This prevents cell division
- O_2 binds to Fe^{2+} in haemoglobin
- **CO substitutes** O_2 and binds more strongly



Shapes of complexes

coordination number (CN), shape, angle

Example	CN	Shape	Angle
$[Cu(H_2O)_6]^{2+}$	6	Octahedral	90°
$[CoCl_4]^{2-}$	4	Tetrahedral (large Cl^-)	109.5°
$[Pt(NH_3)_2Cl_2]$	4	Square planar	90°

Worked examples

Configuration

- V [Ar] $3d^3\ 4s^2$
- Lose 4s, then 3d
- **V^{3+} [Ar] $3d^2$**

Charge

- $Co^{3+} + 5NH_3 + Cl^-$
- +3 + 0 − 1
- **$[Co(NH_3)_5Cl]^{2+}$**

Three isomers

- $[Ni(en)_2Cl_2]$
- Trans: one form
- **Cis: a pair of optical isomers**

Ligand substitution, precipitation and redox reactions follow in the next section.

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